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Insects as pollinators and herbivores: Comparative study in two species of *Luffa* Mill

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Abstract

Among various plant – animal interactions occurring around us, pollination and herbivory are prominent ones, while the former exemplifies a mutualistic relationship, the later is reverse of it. Pollinators by their visits influence both quantity and quality of pollen reaching the surface of stigma. Herbivores on the other hand affect plant reproductive efficiency either through loss of pollen and ovules or by loss of photosynthetic efficiency or by indirectly deterring pollinators. In order to analyze these relationships and their correlation with reproductive success, studies were conducted in two species of Luffa (family – Cucurbitaceae) namely L. cylindrica and L. acutangula growing in Jammu division of J&K state, India (area of study) and interestingly one among the two was found to be reproductively more efficient and less affected by herbivory. The presentation will elaborate in detail on this phenomenon.

Key words: *herbivory, mutualistic relationship, Pollinator, reproductive efficiency, interactions*

1. INTRODUCTION

Reproductive success of the plant depends on both pollination and herbivores, pollination brought about by the pollinators represents critical phase in plant reproduction. Both pollinator and herbivores affect the plant reproductive efficiency. Pollinators deposit large amount of pollen on the stigma and thereby influence the genetic variability which in turn results in higher quality of seeds due to greater competition among pollen grains for ovule fertilization [1]. Herbivores on the other hand reduces the resource availability and hence have an indirect impact on plant reproduction [2]. In order to analyze the affect of plant pollinator and herbivore interaction detailed study was carried out in two species of *Luffa* namely *L. cylindrica* and *L. acutangula* growing in Jammu division of J&K state, India. Present communication deals with the same.

2. MATERIAL AND METHODS

Most observations in *L. cylindrica* and *L. acutangula* were made on the plants raised in Botanical garden, University of Jammu, where as some observations in *L. acutangula* were made on the plants growing in wild in Birpur and Purmundal area of Samba district of J&K state.

2.1 Flower morphology

Detail study on structure of flower was made on 10 inflorescences of each species.

2.2 Insect visitors and pollination ecology

Vines of both the species were regularly observed for various insect visitors, their frequency of visitation to the vine. Specimens of these insects were collected, identified and classified as visitors, robbers, pollinators and herbivores.

2.3 Fruit set and seed set

Percentage fruit set and seed set on open pollination was calculated using following formula:

% age fruit set $\frac{\text{No. of fruits formed per 100 cm branch}}{\text{No. of female flowers per 100 cm branch}} \times 100$

% age seed set $\frac{\text{No. of seeds formed per fruit}}{\text{Total No. of ovules per female flower}} \times 100$

3. RESULTS AND DISCUSSION

Two species of *Luffa* i.e. *L. cylindrica* and *L. acutangula* are climbing vines. Sex expression in both the species is uniform, they are monoecious [3]. Staminate flowers in both the species are borne in axillary racemes, while female flowers are solitary. Flowers of *L. cylindrica* are large (male flower - 9.06 cm ± 0.13, female flower – 10.1cm ± 0.08) and bright yellow coloured. *L. acutangula* have small (male flower – 4.5 cm ± 0.06, female flower – 5.22 cm ± 0.11) and pale yellow coloured flowers. Pistillate flowers are borne singly on short peduncles in both species. Carpels are three in number and fused with short style terminating into trilobed stigma at apex and an inferior ovary at the base.

Male flowers in both the species are nectariferous bearing cup shaped nectary at the base of stamens. A ring shaped nectary is also present at the base of the style in *L. cylindrica* where as it is absent in female flowers of *L. acutangula* [4].

Both the species referred above match in gross morphology and sex expression but they vary vividly in their floral phenology. *L. cylindrica* is diurnal and *L. acutangula* is nocturnal. Blooming period extends for 12 hrs and 15 mins in *L. cylindrica* and 14 hrs and 40 mins in *L. acutangula*. Flowers of both the sexes in both the species do not open again once closed.

Both the species are self fertile and insect pollinated. They are visited by variety of insects and the largest number of insect visitors (butterflies, honey bee, bumble bee, small carpenter bee, syrphid flies, skipper butterfly, red fire ant, black garden ant, and ghost ant) were recorded on *L. cylindrica* due to favourable characters including diurnal opening, huge pollen production (60, 994 per male flower) and nectar production in flowers of both the sexes [3].

L. acutangula on the other hand is visited by few insect visitors among which only two i.e. ghost ant and moths were the legitimate visitors where as rest visitors were either robbers (*Matapa* sp., red fire ant, harvestor ant, black garden ant and hawkmoth) of extrafloral nectary visitor.

It is very uncommon that a herbivore would also act as a pollinator on the same plant where it cause herbivory, but the same has been observed during the present investigation in *L. cylindrica* were *Aulacophora* sp. and *Epilacna* sp. cause herbivory of both vegetative and reproductive tissue and also facilitate in the pollination, whereas the same herbivore has been reported to cause immense damage to both vegetative and reproductive tissue in *L. acutangula*.

Excessive herbivory along with nocturnal opening, lower frequency of pollinators due to absence of primary reward i.e. nectar in female flower leads to dip in reproductive efficiency of *L. acutangula* in terms of small fruit size (14.57 cm ± 0.65 l × 14.4 cm ± 2.90 b vs 36.02 cm ± 1.24 l × 25.4 cm ± 1.21 b), low fruit (21.07 % ± 2.44 vs 74.52 % ± 1.42) and seed set (20.19 % ± 1.18 vs 60.35 % ± 1.9) as compared to *L. cylindrica*.

4. CONCLUSION

L. cylindrica is reproductively more efficient in terms of fruit and seed set due to high and frequent insect visitation and low herbivory damage, where as *L. acutangula* fails to harness the benefits of pollination as well as extra floral nectaries and becomes a more palatable diet for the herbivores, thus have low reproductive efficiency.

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